ABSTRACT

A method and system for thin-shell finite-element analysis based on the use of subdivision surfaces for: (1) describing the geometry of a shell in its undeformed configuration, and (2) generating smooth interpolated displacement fields possessing bounded energy within the strict framework of the Kirchhoff-Love theory of thin shells. The preferred subdivision strategy is Loop's scheme, with extensions to account for creases and displacement boundary conditions. The displacement fields obtained by subdivision are H^2 and, consequently, have a finite Kirchhoff-Love energy. The resulting finite elements contain three nodes and element integrals are computed by a one-point quadrature. The displacement field of the shell is interpolated from nodal displacements only. In particular, no nodal rotations are used in the interpolation. The interpolation scheme induced by subdivision is nonlocal, *i.e.*, the displacement field over one element depends on the nodal displacements of the element nodes and all nodes of immediately neighboring elements. However, the use of subdivision surfaces ensures that all the local displacement fields thus constructed combine conformingly to define one single limit surface. Numerical tests, including known obstacle courses of benchmark problems, demonstrate the high accuracy and optimal convergence of the method.